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PENSOFT

A second record of the recently described *Brachycephalus albolineatus* Bornschein, Ribeiro, Blackburn, Stanley & Pie, 2016 (Anura, Brachycephalidae)

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Abstract

When *Brachycephalus albolineatus* was described, it was known only from its type locality in the state of Santa Catarina, Brazil. Here we provide a new record for the species. Collected specimens were identified in comparison with the type series. We collected 7 specimens in Morro do Garrafão, municipality of Corupá, state of Santa Catarina, at 500–530 m above sea level, in December 2016. The new record is 22 km away from the type locality and also extends the altitudinal distribution of the species, which was previously between 790–835 m above sea level.

Key words

Geographical distribution; altitudinal distribution; extent of occurrence; Santa Catarina; Atlantic Forest.

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Introduction

Brachycephalus Fitzinger, 1826 is a genus of miniaturized montane toadlets (not exceeding 2.5 cm in body length), being among the smallest terrestrial vertebrates in the world (Rittmeyer et al. 2012). The genus encompasses 35 species, of which 29 were described in the last 20 years (Frost 2018). *Brachycephalus* includes diurnal species that live in the forest floor, have direct development (Pombal 1999), and a reduced number and size of digits (Hanken and Wake 1993, Yeh 2002, Clemente-Carvalho et al. 2009). Some species are brightly colored and have neurotoxins in their skin, possibly originated from intestinal bacteria (Schwartz et al. 2007). The genus is subdivided into 3 phenetic groups, namely *B. didactylus*, *B. pernix*, and *B. ephippium* (Ribeiro et al. 2015). The entire genus is endemic to Brazilian Atlantic Forest, but species from each group show distinct altitudinal and latitudinal distributions (Bornschein et al. 2016a). The *B. didactylus* group includes only 4 species [*B. didactylus* (Izecksohn, 1971), *B. hermogenesi* (Giaretta & Sawaya, 1998), *B. pulex* Napoli, Caramaschi, Cruz & Dias, 2011, and *B. sulfuratus* Condez, Monteiro, Comitti, Garcia, Amaral & Haddad, 2016] distributed latitudinally along the entire geographical distribution of the genus and are

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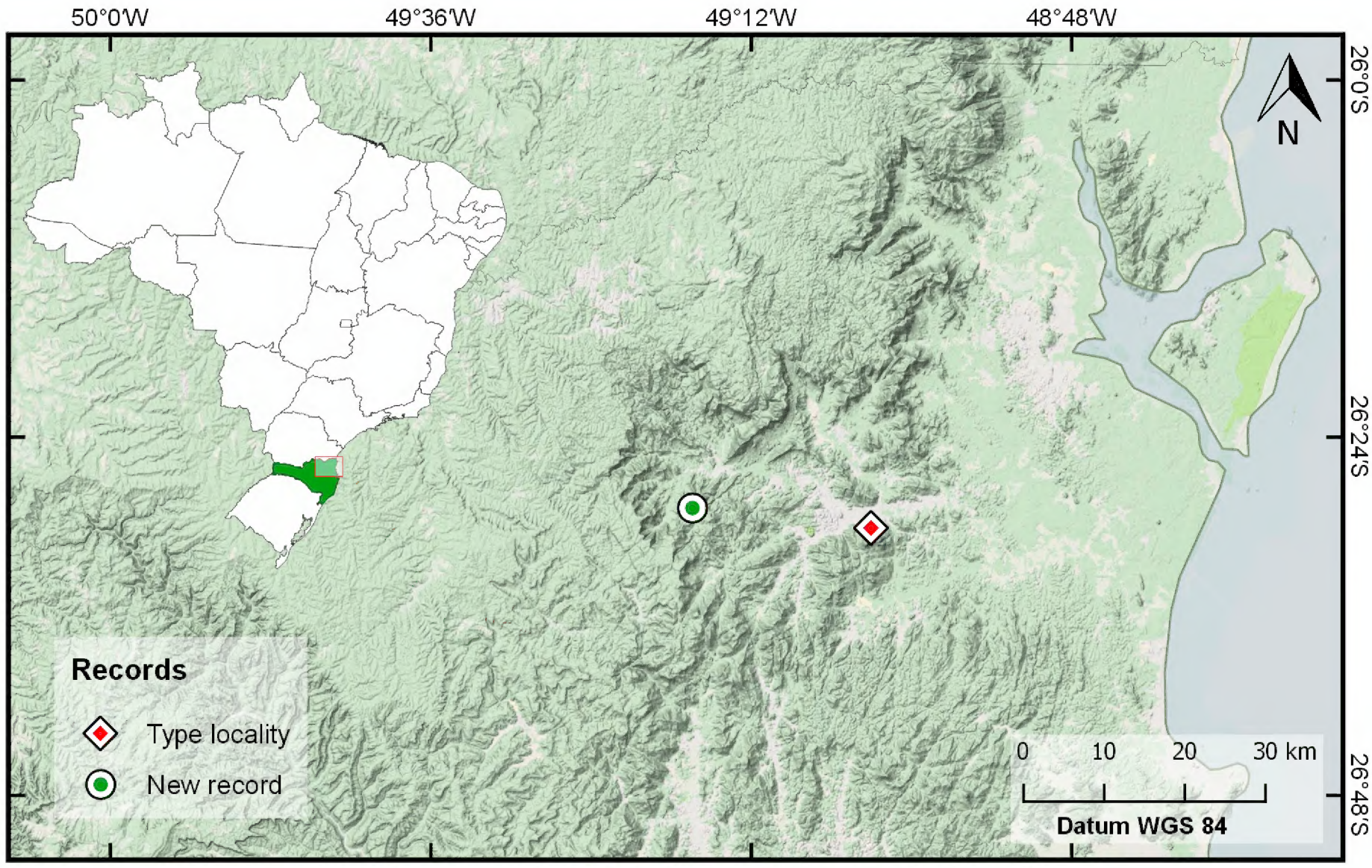

Figures 1. Map indicating the new record of *Brachycephalus albolineatus* (Morro do Garrafão; green dot) in comparison with the previous record, type locality of the species (Morro Boa Vista; red diamond), Santa Catarina, southern Brazil.

also variable altitudinally, with species occurring from sea level until 1,110 m above sea level (a.s.l.) (Bornschein et al. 2016a, Pie et al. 2018). Species from the remaining groups are less variable, occurring mostly at higher altitudes, with species of the *B. ephippium* group distributed altitudinally from 200–1,900 m a.s.l. and geographically from São Paulo to the north through Minas Gerais, while species from the *B. pernix* group are distributed altitudinally from 20–1,640 m a.s.l. and geographically only in southern Brazil, in Paraná and Santa Catarina (Bornschein et al. 2016a, Monteiro et al. 2018). *Brachycephalus ephippium* group includes B. *alipioi* Pombal & Gasparini, 2006, *B. bufonoides* Miranda-Ribeiro, 1920, *B. crispus* Condez, Clemente-Carvalho, Haddad & Reis, 2014, *B. darkside* Guimarães, Luz, Rocha & Feio, 2017, *B. ephippium* (Spix, 1824), *B. garbeanus* Miranda-Ribeiro, 1920, *B. guarani* Clemente-Carvalho, Giaretta, Condez, Haddad & Reis, 2012, *B. margaritatus* Pombal & Izecksohn, 2011, *B. nodoterga* Miranda-Ribeiro, 1920, *B. pitanga* Alves, Sawaya, Reis & Haddad, 2009, *B. toby* Haddad, Alves, Clemente-Carvalho & Reis, 2010, and *B. vertebralis* Pombal, 2001 (Bornschein et al. 2016a, Guimarães et al. 2017), whereas *B. pernix* group includes *B. actaeus* Monteiro, Condez, Garcia, Comitti, Amaral & Haddad, 2018, *B. albolineatus* Bornschein, Ribeiro, Blackburn, Stanley & Pie, 2016, *B. auroguttatus* Ribeiro, Firkowski, Bornschein & Pie, 2015, *B. boticario* Pie, Bornschein, Firkowski, Belmonte-Lopes & Ribeiro, 2015, *B. brunneus* Ribeiro, Alves, Haddad & Reis, 2005, *B. coloratus* Ribeiro, Blackburn, Stanley, Pie & Bornschein, 2017, *B. curupira* Ribeiro, Blackburn, Stanley, Pie & Bornschein 2017, *B. ferruginus* Alves, Ribeiro, Haddad & Reis, 2006, *B. fuscolineatus* Pie, Bornschein, Firkowski, Belmonte-Lopes & Ribeiro, 2015, *B. izecksohni* Ribeiro, Alves, Haddad & Reis, 2005, *B. leopardus* Ribeiro, Firkowski & Pie, 2015, *B. mariaeterezae* Bornschein, Morato, Firkowski, Ribeiro & Pie, 2015, *B. mirissimus* Pie, Ribeiro, Confetti, Nadaline & Bornschein, 2018, *B. olivaceus* Bornschein, Morato, Firkowski, Ribeiro & Pie, 2015, *B. pernix* Pombal, Wistuba & Bornschein, 1998, *B. pombali* Alves, Ribeiro, Haddad & Reis, 2006, *B. quiririensis* Pie & Ribeiro, 2015, *B. tridactylus* Garey, Lima, Hartmann & Haddad, 2012, and *B. verrucosus* Ribeiro, Firkowski, Bornschein & Pie, 2015 (Bornschein et al. 2016a, b, Pie and Ribeiro 2015, Ribeiro et al. 2017, Monteiro et al. 2018, Pie et al. 2018). Many species of *Brachycephalus* present microendemism, occurring in only one or a few adjacent mountaintops, with total extents of occurrence comparable to the smallest ranges of species of the world (Bornschein et al. 2016a). The microendemism in *Brachycephalus* is associated with their need of specific environmental conditions, such as high humidity and cold, found in high altitude regions, such as cloud forests (Pie et al. 2013, Bornschein et al. 2016a).

In the recent years, a project was conducted focusing on the diversity and ecology of montane frogs from southern Brazil. The obtained results included the discovery and description of several new species (Bornschein et al. 2015, 2016b, Pie and Ribeiro 2015, Ribeiro et al. 2015, 2017, Pie et al. 2018) and description of their advertisement calls (Bornschein et al. 2018). In the present study, we report a second record of *B. albolineatus*, a member

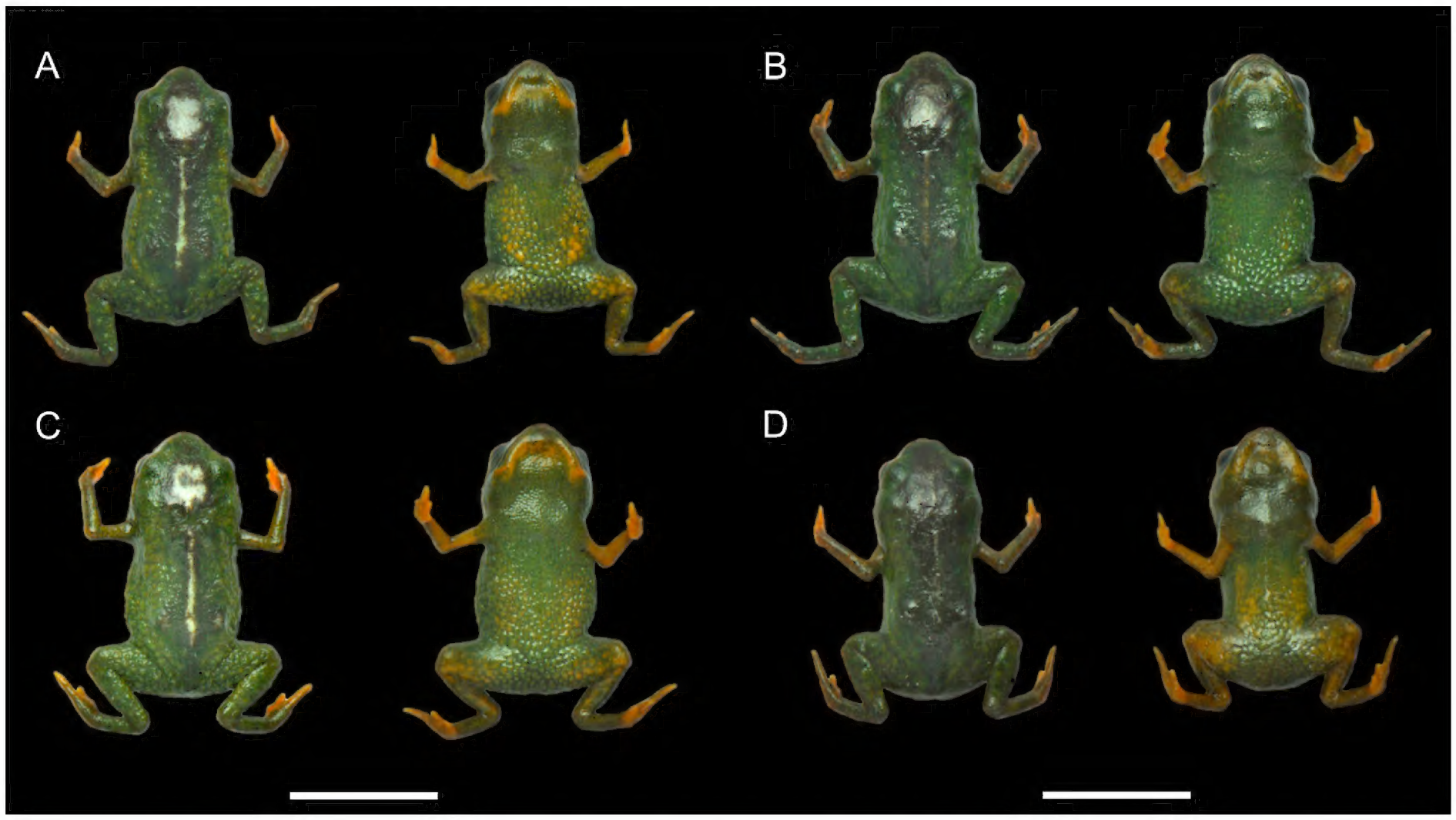

Figure 2. Representative variation in coloration of *Brachycephalus albolineatus* from Morro do Garrafão, municipality of Corupá, Santa Catarina, southern Brazil. All adults are alive and shown in dorsal and ventral view. **A.** MHNCI 10840. **B.** MHNCI 10842. **C.** MHNCI 10836. **D.** MHNCI 10839. Abbreviation: MHNCI = Museu de História Natural Capão da Imbuia, Curitiba, Paraná. Scale bars = 5 mm.

of the *B. pernix* group recently described and only known from its type locality, a mountain top in northeastern Santa Catarina, southern Brazil (Bornschein et al. 2016b).

Methods

Records were obtained on field trips that we did exclusively to access mountains ranges to find populations of *Brachycephalus*. We walked slowly through the forests during the day, listening to calls typical of *Brachycephalus* that we collected over the past few decades. Upon detecting those calls, we carefully walked in the direction of the emitter and, then, removed leaves and other detritus trying to find the toadlets. Specimens were collected to allow us to identify the species under permits issued by ICMBIO-SISBIO (55918-1). They were deposited in the Museu de História Natural Capão da Imbuia (MHNCI), Curitiba, state of Paraná, Brazil. We anaesthetized and euthanized specimens in laboratory using 2% lidocaine, fixed in 10% formalin and stored in a 70% ethyl alcohol solution. The habitat characterization was made according to Veloso et al. (1991).

To identify the collected specimens, we compared them with the original description of *Brachycephalus albolineatus* (Bornschein et al. 2016b), with the preserved specimens of the type series, and with photographs of live and preserved specimens by LFR, of which some are available in figures 1, 3 and 4 of Bornschein et al. (2016b).

Results

New records. Brazil: Santa Catarina: municipality of Corupá: Morro do Garrafão (26°28′23″ S, 049°15′57″ W; 500–530 m a.s.l.) (Fig. 1), 11 December 2016, coll. by Leandro Corrêa (1 specimen; MHNCI 10836). Ibid., 14 December 2016, coll. by Luiz F. Ribeiro, Leandro Corrêa, and André E. Confetti (3 specimens; MHNCI 10837–9). Ibid., 15 December 2016, ibid. (3 specimens; MHNCI 10840–2).

We heard the advertisement calls of several individuals (and recorded some of them) under leaf litter of the forest floor, where we collected the specimens by searching through litter. The forest type was recognized as Floresta Ombrófila Densa Montana. The surroundings of the collection site (up to 1 km) include open areas formed by deforestation, with forest substituted by pastures, monocultures cultivation (*Eucalyptus* sp. and *Pinus* sp.), and houses. In addition, the surroundings encompass an extensive area of secondary vegetation grown at sites that have been deforested, as well as primary forests altered by selective logging.

Identification. We identified the collected specimens by the following set of characteristics: "bufoniform" body shape, dorsum smooth, and general color in life of the dorsal region of head, dorsum, legs, arms and flanks light, brownish green to dark, olive green, always with a dark green region along the middle of the dorsum and a white line along the vertebral column in most specimens (Fig. 2).

Discussion

We present a second record of *Brachycephalus albolineatus*, a species previously known only from its type locality. Both localities are 21.8 km in a straight line. The new record at 500 m a.s.l. also extends the altitudinal

range of the species, previously known between 790–835 m a.s.l. (Bornschein et al. 2016b). Most species of the *B. pernix* group of Santa Catarina occur at lower altitudes than the species of the same group to the north, in Paraná, and the current altitudinal record reported here confirms this tendency. The lowest record for the species of *B. pernix* group in Santa Catarina is 20 m a.s.l. (Monteiro et al 2018) and in Paraná is 805 m a.s.l. (Bornschein et al. 2016a).

Despite this second record of the species more than 20 km away from the previously known record, the species was not found on a mountain only 4.8 km of distance from this previously known record (i.e. Pedra Branca, 26°32′52″ S, 049°05′11″ W; 700–730 m a.s.l.; Bornschein et al. 2016b). This suggests the possibility that the authors overlooked the species in that locality.

These new altitudinal and geographic distribution data presented shows that the estimate of extent of occurrence of 34.4 ha is no longer the global estimate (Bornschein et al. 2016a). Finally, we report that we found *Brachycephalus albolineatus* in Morro do Garrafão in syntopy with *B. sulfuratus*. This is one of a few cases of syntopy between *Brachycephalus* species (Bornschein et al. 2016a).

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Authors' Contributions

MRB, LFR, LC, LT, AEC and MRP conducted fieldwork; LFR, LC and AEC collected the data; LT and MRB wrote the text; MRB and LFR did the analysis; LFR took the photographs.

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